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NATIONAL DAM INSPECTION PROGRAM. ELM LAKE DAM, NDI-PA-00397, PA--ETC(U)
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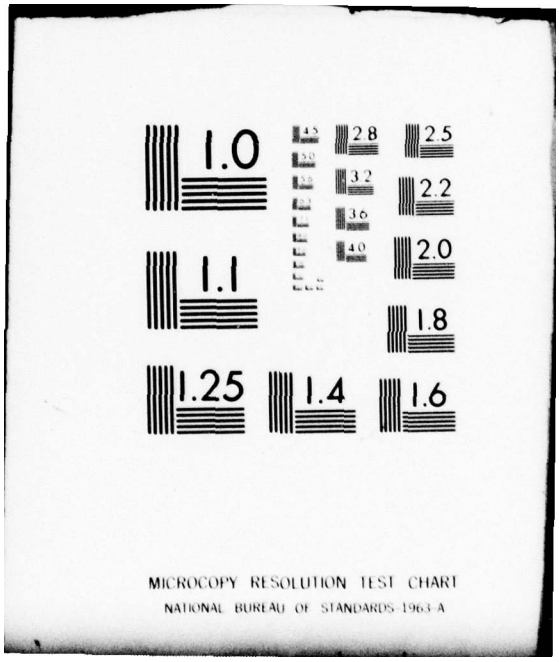
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DELAWARE RIVER BASIN

YORK CREEK, PIKE COUNTY

PENNSYLVANIA

ELM LAKE DAM

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NDI - PA 00397

PA DER 52 - 164

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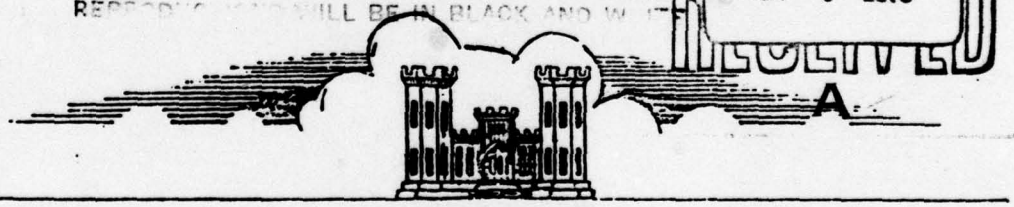

PREPARED FOR

DEPARTMENT OF THE ARMY

BALTIMORE DISTRICT, CORPS OF ENGINEERS

BALTIMORE, MARYLAND 21203

FEBRUARY 1979

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DELAWARE RIVER BASIN

Name of Dam: Elm Lake Dam
County and State: Pike County, Pennsylvania
Inventory Number: PA 00397

PHASE I INSPECTION REPORT
NATIONAL DAM ~~SAFETY~~ PROGRAM

(15) DACW31-79-C-0010

Prepared by:

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

(6) National Dam Inspection Program. Elm Lake Dam, NDI-PA-00397, PA-DER-52-164, Delaware River Basin, York Creek, Pike County, Pennsylvania. Phase I Inspection Report.

For:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, MD 21203

(11) Feb 79

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Elm Lake Dam **ID # PA 00397**
State Located: Pennsylvania
County Located: Pike
Stream: York Creek
Coordinates: Latitude 41° 19.6' Longitude 75° 3.1'
Date of Inspection: November 20-21, 1978

ASSESSMENT

Elm Lake Dam, owned by Home Smith International Ltd. (Hemlock Farms), is an earth embankment approximately 1,500 feet long and 28 feet high at its maximum section. An ungated drop spillway is located approximately 400 feet from the left abutment (looking downstream). The 28 acre reservoir is used for recreation by the residents of Hemlock Farms. One home is located along the fringe of the flood plain downstream of the dam. Therefore, the dam is in the significant hazard category.

Examination of the results of the hydrologic and hydraulic analyses indicates that the spillway is capable of passing 99% of the Probable Maximum Flood (PMF) without overtopping of the embankment.

Based on visual observations made during the date of inspection, the dam is considered to be in fair condition. However, the uneven nature of the surface along the top of dam is indicative of settlement or poor construction methods. The embankment should be monitored periodically to detect signs of differential movement.

The riprap protection for the upstream slope of the embankment is poorly graded and sparse in many areas. The riprap on the upstream face should be supplemented, replaced and regraded where necessary.

A marshy area with standing water, approximately 500 square feet, is evident along the downstream toe of the embankment near the right (look downstream) abutment. This area should be regraded to provide adequate drainage. Flow should be monitored to detect turbidity or increases in flow.

Although a flow of not less than 36,000 gallons per day (0.056 cfs) is to be maintained in the stream immediately below the dam, on the day of the inspection there was no flow in the channel downstream. The reservoir drain system is inoperable and in need of immediate repair.

Because of the home located a short distance downstream of the dam, a procedure for observation and warning during periods of high flow should be developed and implemented.

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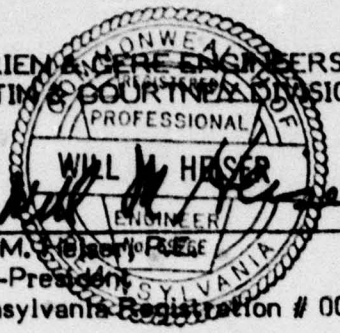


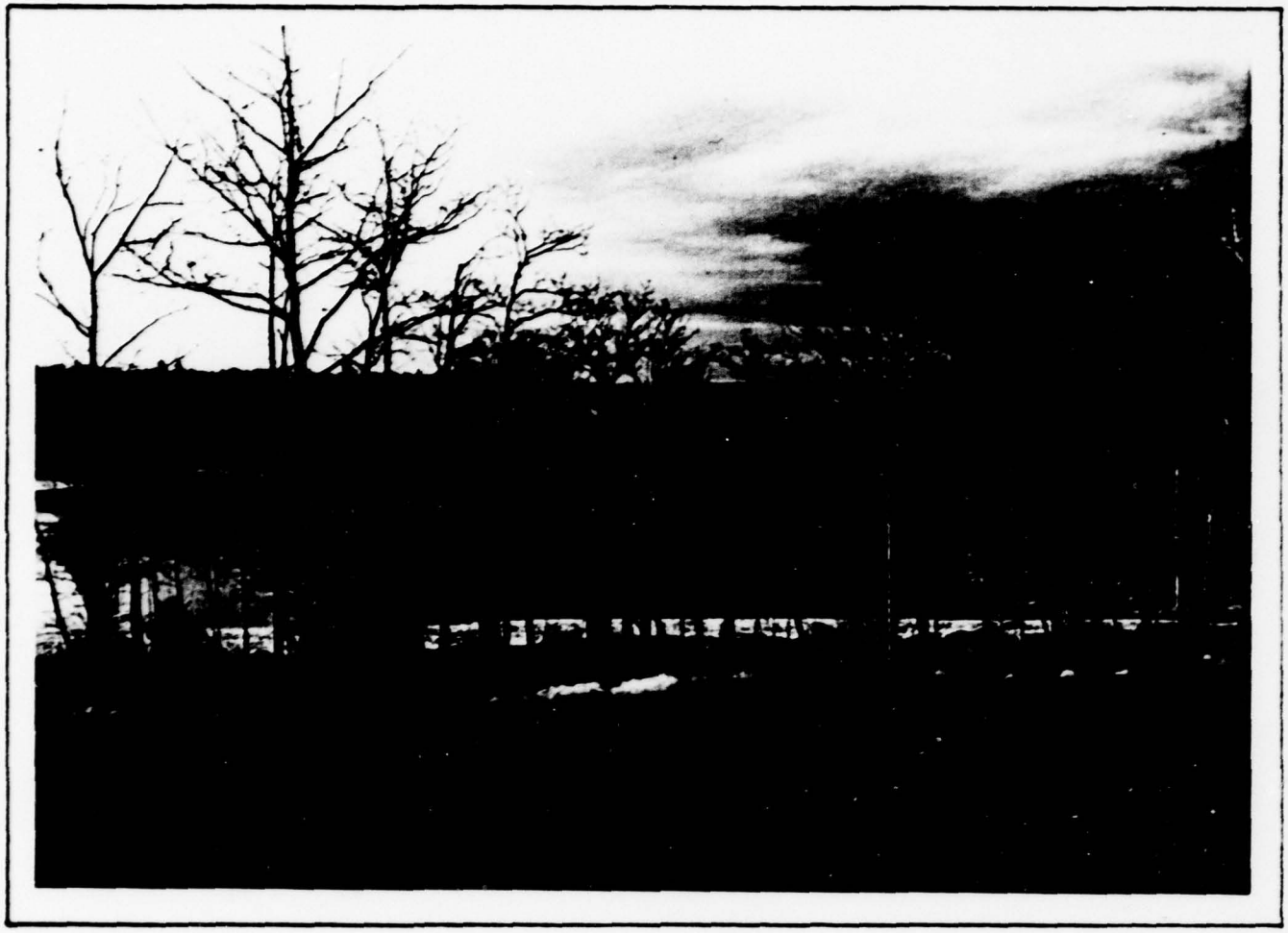
Will M. Hesser, P.E.
Vice-President
Pennsylvania Registration # 006926-E

Date: 3/15/79

APPROVED BY _____

C. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date: 11 Apr 79



OVERVIEW
ELM LAKE DAM
PIKE COUNTY, PENNSYLVANIA

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(Continued)

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
ELM LAKE DAM
NDI I.D. NO. PA 00397

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of this inspection is to evaluate the structural and hydraulic conditions of the Elm Lake Dam and appurtenant structures and to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. (Information obtained from the Pennsylvania Department of Environmental Resources, Dam Safety Section).

Elm Lake Dam (formerly York Lake Dam) is an earth embankment, approximately 1,500 feet in length with a maximum height of 28 feet. The dam impounds a reservoir with a surface area of 28 acres and a storage capacity of 215 acre-feet at normal pool. The top of the dam is 16 feet wide and the side slopes are 2.5 horizontal to 1 vertical (2.5H:1V). The embankment is composed of an impervious central core with an outer shell of rock and semipervious material. The central core is 10 feet wide at the top of the dam and has side slopes of 1.5H:1V. A key trench of impervious material connects the base of the central core to underlying bedrock or impervious material. The centerline of the key trench is 10 feet upstream of the dam centerline. The key trench has a bottom width of 10 feet and sides slope 1H:1V to original ground. An 18-inch thick layer of riprap overlying a 6-inch base of crushed stone is placed on the upstream face for erosion control between elevations 1407 and 1413 (normal water surface is at elevation 1410). From the right abutment (looking downstream) to a point approximately 570 feet from the right abutment, a four-foot deep toe drain lies beneath a 3-foot thick sand filter at the base of the downstream shell. The toe drain, as designed, consists of a 6-inch porous concrete pipe surrounded by graded gravel or crushed stone with a top filter of sand and gravel and a bottom filter of graded sand.

The reinforced concrete drop spillway, located approximately 400 feet from the left abutment, is 16 feet wide and has an 8-foot drop from the weir crest (Elev. 1410.0) to the apron. Training walls form a 20.5-foot long approach channel which has a riprapped invert 2 feet below the drop spillway crest. The outlet

channel (invert Elev. 1402.0) extends 47.0 feet downstream from the drop spillway headwall. The side walls have a slight inward batter so that the outlet channel is 12 feet wide 47.0 feet downstream of the headwall. At this point the channel drops to elevation 1400.5 and becomes a trapezoidal shaped grouted riprap section which extends an additional 200 feet downstream on an 8 percent grade. This section outlets into a 50-foot long, nongrouted, riprap lined channel on a 5 percent slope. A cutoff wall to elevtion 1414.0 extends 6 feet beyond both sides of the spillway along the centerline of the dam. Another cutoff wall is located between the grouted riprap outflow channel section and the riprap lined section.

The reservoir drain system consists of a 24-inch corrugated metal pipe encased in a 3-foot square reinforced concrete section. The pipe is approximately 130 feet long and flow is controlled by a 24-inch sluice gate in the inlet structure. Four seven-foot square reinforced concrete anti-seep collars are spaced at 20-foot intervals along the pipe. The invert elevation of the pipe at the intake is 1389; the outlet elevation is 1388.

b. Location. Elm Lake Dam is located on York Creek in the Hemlock Farms resort community. Hemlock Farms is in Blooming Grove Township, Pike County, Pennsylvania, about 30 miles east southeast of Scranton. The dam site is shown on the USGS Quardrangle entitled "Pecks Pond, Pennsylvania" at coordinates N 41° 19.6', W 75° 3.1'. A regional location plan of Elm Lake Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. The maximum height of 28 feet and storage capacity of 365 acre feet place Elm Lake Dam in the small size category.

d. Hazard Classification. There is only one inhabitable structure within the area that would be flooded by a failure of the dam, but the loss of life potential exists. Therefore, the dam falls into the significant hazard category.

e. Ownership. Elm Lake Dam is owned by Home Smith International Ltd. (Hemlock Farms), Lords Valley, Hawley, PA 18428.

f. Purpose of Dam. The dam was constructed to create a lake for recreational purposes.

g. Design and Construction History. Elm Lake Dam was designed by Clifford L. Dennis of Edward C. Hess Associates, Inc., and was constructed by G.H. Litts and Son, Inc. The construction began in September of 1970 and was completed in June of 1972. There is no record of any subsequent remedial work on the dam.

h. Normal Operating Procedure. The only operational feature of the dam is the reservoir drain system. Complete or partial opening of the sluice gate would allow for drawdown of the reservoir if required. The reservoir surface is normally maintained at the crest of the drop spillway.

1.3 Pertinent Data (from information supplied by Pennsylvania DER and USGS).

a. Drainage Area. (square miles) 0.37

b. Discharge at Dam Site. (CFS)

Maximum Known Flow	100
Reservoir Drain System (normal pool)	52
Reservoir Drain System (top of dam)	58
Drop Spillway (top of dam)	630
Minimum Flow Required	0.056

c. Elevation (feet above MSL)

Drop Spillway Crest (Normal Pool)	1410.0
Top of Dam (Design)	1415.0
Reservoir Drain Invert (inlet)	1389.0
Reservoir Drain Invert (outlet)	1388.0
Streambed at centerline of dam	1388.0

d. Reservoir (miles)

Length of Normal Pool	0.34
Length of Maximum Non-overtopping Pool	0.40
Fetch at Normal Pool	0.34

e. Storage (acre-feet)

Normal Pool, Elev. 1410.0	215
Top of Dam, Elev. 1415.0	365

f. Reservoir Surface Area (acres)

Normal Pool, Elev. 1410.0	28
Top of Dam, Elev. 1415.0	34

g. Dam Data

Type	Earth
Length	1500 feet
Height	28 feet (maximum)
Crest Width	16 feet
Side Slopes (Upstream & Downstream)	2½H:1V
Zoning	Impervious core & semi-pervious shell
Cutoff	Impervious key trench
Grout Curtain	None

h. Diversion and Regulating Tunnel

Does not apply to this site

i. Spillway

Type	Reinforced concrete drop spillway.
Width	16 feet
Crest Elevation	1410
Gates	None
Upstream Channel	Training Walls to 20.5 feet upstream of headwall, approach channel invert elevation 1408.0.
Downstream Channel	50-foot length of reinforced concrete slab at elevation 1402.0 with training walls; 200-foot length of trapezoidal grouted riprap channel, dropping from elevation 1400.5 to 1384.5; 50-foot length of riprap-faced channel, dropping from elevation 1384.5 to 1382

j. Regulating Outlets

Type	24-inch corrugated metal pipe encased in reinforced concrete.
Length	130 feet
Closure	24-inch sluice gate in intake structure
Access	Intake structure is submerged, handwheel for operating the slide gate is located on the crest of the dam.
Regulating Facilities	Hand operated wheel

SECTION 2
ENGINEERING DATA

2.1 Design

a. Data Available. The information available for review of Elm Lake Dam includes the following (all information contained in the Pennsylvania DER main office files in Harrisburg, Pennsylvania):

1. "Application", "Report Upon the Application", and "Permit" to construct Elm Lake Dam, 1969-1970.
2. Design drawings.
3. Soil field density testing results
4. Concrete quality testing results.
5. Construction progress photographs
6. General specifications
7. Miscellaneous correspondence, inspection reports, construction reports, etc.

Note: Design data is not available.

b. Design Features. The design features are described in Section 1.2.a. (Description of Project, Dam and Appurtenances). The principal design features for the structure are shown on Plates 2 and 3 in Appendix E.

2.2 Construction

Based on the field investigation and the information available in the construction reports, the dam appears to have been constructed in general conformanced with the construction drawings.

2.3 Operation

Operational procedures are limited to the control of the sluice gate for the reservoir drain system.

2.4 Evaluation

a. Availability. The engineering data utilized in this report is provided by the Pennsylvania DER.

b. Adequacy. There are no design calculations included in the information provided by DER.

c. Validity. There is no reason to question the validity of the data presented.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Elm Lake Dam took place on November 20-21, 1978. At the time of the inspection, the reservoir surface was approximately 1.5 feet below the crest of the spillway. No underwater areas were inspected.

b. Dam. There are numerous bulges, and depressions which form an undulating pattern along both the upstream and downstream slopes and the top of the dam. A survey revealed that the top of the dam elevation varies as much as 1.5 feet along the length of the embankment. The riprap facing varies in gradation and thickness. Predominantly large rocks have been dumped in some areas, small stones in other areas, and no cover at all in still other areas. The grass cover on the embankment slopes is sparse; there is virtually no grass cover along the top of the dam. There is a large area of standing water between the reservoir drain outlet and the right abutment just downstream of the toe.

c. Appurtenant Structures. The reservoir drain system is inoperable. The stem leading to the sluice gate is bent, cracked, and rusted and the hoist mechanism is in very poor condition. Repairs to the stem had apparently been attempted since one section is welded, but the remainder of the stem is still in a state of disrepair. The outlet pipe is partially buried in mud and debris. A small amount of water is flowing from the toe drain outlets in the outlet structure.

The drop spillway appears to be in good condition. The drop spillway outlet channel differed slightly from that shown on the drawings. According to the drawings, each training wall is to converge and then reduce the width of the channel by 2 feet along its 50-foot length. However, the right training wall is straight and the left training wall has an inward batter of 4 feet along its 50-foot length.

A special condition for the construction of Elm Lake Dam specifies a minimum flow to be maintained in the stream immediately below the dam. On the dates of the inspection, this requirement was not being met because there was no flow through the drop spillway.

d. Reservoir Area. A sand beach covers the shoreline from the right abutment to a point about 600 feet upstream of the right abutment. There is no visible evidence of slope failures around the reservoir; the slopes have a mild grade and are well vegetated.

e. Downstream Channel. The natural stream channel extends through a marshy meadow region. The outlet channel of the drop spillway terminates at the

meadow 500 feet from the natural channel. Flow from the natural channel leaves the meadow through a corrugated metal culvert under a road embankment about 2,300 feet downstream of the dam. The culvert is 5 feet high and 10 feet wide.

There is only one house within the area that would be flooded in the event of a dam failure; the natural ground surface around the house is approximately 5 feet below the top of dam. Therefore, the dam has been reclassified as significant hazard.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedures

Normal operating procedures for this structure do not require a dam tender. The only operation would be to draw down the reservoir by opening the sluice gate. This procedure is not possible due to the condition of the gate stem and hoist. There are no written operating procedures.

4.2 Maintenance of the Dam

According to Mr. Thomas Clauss, Public Works Director of the Hemlock Farms Community Organization, maintenance of the structure is the responsibility of this organization. However, at the time of inspection there was no evidence of recent maintenance.

4.3 Maintenance of Operating Facilities

The condition of the operating facilities reveals a lack of maintenance.

4.4 Warning Systems in Effect

There is no formal warning system in effect for Elm Lake Dam.

4.5 Evaluation

At present the reservoir can not be drawn down; therefore the operating facilities should be repaired immediately.

Since there is the possibility of loss of life and appreciable property damage downstream in the event of failure, a formal warning procedure should be implemented.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Original design information is limited to the material in the Application Report, dated April 27, 1970.

Elm Lake Dam watershed is about 1.0 mile long and averages about 0.4 miles wide, with a total drainage area of 0.37 square miles. Elevations range from 1590 to 1410 at normal reservoir level. The slope of the watershed adjacent to the reservoir is about 15 percent. The watershed is nearly 100 percent wooded and the entire watershed is owned by Home Smith International Ltd. (Hemlock Farms).

The spillway is designed to have a maximum discharge of 645 cfs.

b. Experience Data. Mr. Thomas Clauss stated that no rainfall records or reservoir level records are kept for Elm Lake Dam. According to Mr. Clauss, the maximum reservoir elevation has been about 18 inches above the spillway crest. This corresponds to a discharge of approximately 100 cfs.

c. Visual Observations. The inoperable reservoir drain system could present a serious problem should a draw down of the reservoir be required. The outlet structure of the reservoir drain system is partially buried in mud and debris and needs to be cleaned out.

Further observations are given in Appendix B.

d. Overtopping Potential. The established range for the Spillway Design Flood (SDF) is the 100-year flood to ½ PMF. The recommended SDF is ½ PMF. The peak inflow and outflow rates for ½ PMF are 490 cfs and 290 cfs respectively. The spillway is capable of discharging the SDF without overtopping of the embankment. (See Appendix C for computations.)

e. Spillway Adequacy. The Elm Lake Dam spillway is classified as adequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The uneven surface along the top of dam and side slopes of the embankment could be the result of settlement or poor construction methods. The relation of the undulations to the stability of the structure could not be assessed. The riprap on the upstream face of the dam is poorly graded, unevenly distributed, and provides inadequate coverage. The poorly established grass cover on the dam does not provide protection against surface erosion.

An area of ponded water was located near the right abutment just downstream of the toe of the dam. The source of the water could not be determined, but could be the result of poor drainage or seepage through or beneath the embankment.

Inspection of the drop spillway revealed no deterioration of concrete surfaces. According to the design drawings, reinforcing bars joint the spillway to the training walls, and a layer of crushed stone provides for drainage beneath the spillway apron.

b. Design and Construction Data. Field density test reports and the construction drawings are the only design and construction data available in the DER office. The field inspection appears to indicate that the structure was built in general conformance with the design drawings.

c. Operating Records. There are no official operating records kept for this dam. The minimum flow requirement of 0.056 cfs. immediately downstream of the dam is not being maintained.

d. Post-Construction Changes. There is no record of any modifications subsequent to the completion of construction.

e. Seismic Stability. Elm Lake Dam is located in Seismic Zone 1 on the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 is generally considered to be safe under any earthquake loading conditions if it is safe under static loading conditions.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Evaluation. Based on the visual inspection the earth embankment is considered to be in fair condition. Lack of maintenance has resulted in deterioration of the reservoir drain system. At present the reservoir can not be drawn down. Other problems are surface undulations, inadequate riprap, standing water, and poor grass cover. The drop spillway is in good condition and is hydraulically adequate.

b. Adequacy of Information. Design calculations were not included in the information obtained from DER.

c. Urgency. The remedial measures recommended in Section 7.2 should be effected as soon as possible.

d. Necessity for Further Investigation. Further investigation is not considered necessary at this time.

7.2 Recommendations and Remedial Measures

a. Facilities

1. Immediate repairs should be made on the reservoir drain system to provide for reservoir draw down. The outlet structure should be cleared of mud and debris to allow free flow from the outlet pipe.

2. The riprap on the upstream face should be supplemented, regraded and replaced where necessary to provide adequate protection against wave erosion. The riprap should be removed so that a crushed stone base may be placed beneath the riprap in any location where such a base does not exist.

3. The top of the dam should be raised to the design top of the dam elevation in any areas that are below grade to prevent overtopping at stages less than maximum pool.

4. The top and downstream slopes of the embankment should be reseeded in areas where the grass cover is poor to minimize erosion from runoff.

5. The marshy area downstream of the embankment should be regraded to provide adequate drainage. Flow should be monitored to detect turbidity or increases in flow.

b. Operation and Maintenance Procedures

1. Because of the home located a short distance downstream of the dam, a procedure for observation and warning during periods of high flow should be developed and implemented.

2. The owner should develop and implement a maintenance and inspection checklist to insure that all items are maintained on a regular basis.

APPENDIX

A

Check List Engineering Data

Design, Construction, Operation

Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Elm Lake Dam

ID # PA 00397

ITEM	REMARKS
AS-BUILT DRAWINGS	No as-built drawings are available, but design drawings appear to be consistent with the actual structure.
REGIONAL VICINITY MAP	See Plate 1, Appendix E
CONSTRUCTION HISTORY	Construction progress reports and photographs are available in the DER files.
TYPICAL SECTIONS OF DAM	Included in design drawings. See plates 2 and 3, Appendix E
OUTLETS - PLAN	See Plate 3 for available drawings.
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	None Available
RAINFALL/RESERVOIR RECORDS	None Available

ITEM	REMARKS
DESIGN REPORTS	None Available
GEOLOGY REPORTS	None Available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None Available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Field density test records for embankment materials are available, as are concrete strength testing records.
POST-CONSTRUCTION SURVEYS OF DAM	None Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	None Observed
MODIFICATIONS	None Noted
HIGH POOL RECORDS	No formal records. Highest observed stage was 18 inches above the drop spillway crest during hurricane "Agnes" in June 1972.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	No prior accidents reported.
MAINTENANCE OPERATION RECORDS	None Available

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	See Plate 3, Appendix E, for available drawings.
OPERATING EQUIPMENT PLANS & DETAILS	See Plate 3, Appendix E, for available drawings.
MISCELLANEOUS	Various memoranda concerning design and construction difficulties are also available in DER files.

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam ELM LAKE County Pike State Penna. National ID # PA 00397

Type of Dam Earth Hazard Category Significant

Date(s) Inspection Nov. 20-21, 78 Weather Cloudy Temperature 30° - 35° F

Pool Elevation at Time of Inspection 1408.5 M.S.L. Tailwater at Time of Inspection < 1388 M.S.L.

Inspection Personnel:

Mr. Leonard Beck Mr. Robert Bowers

Mr. David Campbell

Mr. David Campbell Recorder

Remarks:

Mr. Thomas Clauss, Public Works Director of the Hemlock Farms Community Organization answered questions concerning Elm Lake Dam during our meeting with him at the Hemlock Farms office.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None Observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None Observed	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The crest and the upstream & downstream slopes are undulationed bulged, and depressioned throughout the length of the embankment.	The crest of the dam should be raised to design crest elevation in any areas that are below grade.
RIPRAP FAILURES	The Riprap is inadequate; it appears that it was randomly dumped during construction. Some minor failures may also have occured since construction.	Repair of the Riprap is recommended where required.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DRAINS	A small amount of water (about .5 GPM) was flowing from the toe drain outlets.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The crest elevation was somewhat depressed at the spillway and dam junction (see Profile, Sheet 5, Appendix E).	Surveying of the crest is recommended, with a raising of the crest wherever it drops below design elevation.
ANY NOTICEABLE SEEPAGE	No seepage was observed. However, there was an area of standing water along the toe near the right abutment.	Regrading of the area is recommended to permit drainage.
STAFF GAGE AND RECORDER	None	
DRAINS		

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None Observed	
INTAKE STRUCTURE	The intake structure was submerged, but a portion of the stem for operation of the sluice gate was exposed and is inoperable.	Immediate repair of the sluice gate controls is recommended.
OUTLET STRUCTURE	The outlet structure was partially blocked with mud.	Clearing of the outlet structure is recommended to allow fullflow if necessary.
OUTLET CHANNEL	There was token flow in the poorly defined outlet channel.	Outlet channel should be cleaned out.
EMERGENCY GATE	The sluice gate in the intake structure controls the reservoir drain. The gate is inoperable because of the condition of the hoist and stem.	The gate system should be repaired immediately.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete wall with Quarter-Circular top section is in good condition.	
APPROACH CHANNEL	The approach channel (Training walls and riprap covered channel) appear to be in good condition.	
DISCHARGE CHANNEL	The sections of channel (Concrete slab, training walls, grouted rip-rap and ungrouted riprap sections) below the spillway appeared to be in good condition. The discharge channel empties directly into the valley and not the stream.	Continuation of the channel down to York Creek is recommended for proper drainage.
BRIDGE AND PIERS	None	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	The report on the application for Elm Lake Dam required weirs for measuring flow in the stream just below the dam. No such weirs were observed.	
PIEZOMETERS	None	
OTHER	None	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Reservoir slopes are mild and well vegetated.	
SEDIMENTATION	Unknown	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel flows through a desolate, bowl-shaped valley, then beneath a road embankment, which forms another dam 2,300 feet downstream of Elm Lake Dam. The upstream road embankment is riprap faced. This road embankment would contain most of a flood within the valley.	
SLOPES	The stream channel is on about a 2% grade.	
APPROXIMATE NO. OF HOMES AND POPULATION	Only one home downstream of the dam lies within the area that would be affected by a flood resulting from a dam failure.	

APPENDIX

C

Hydrologic & Hydraulic Data

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
ELM LAKE . DAM				

TABLE OF CONTENTS APPENDIX C

HYDROLOGIC & HYDRAULIC DATA

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
ELM LAKE DAM	1	RRB	12/21/78	

HYDROLOGY CALCS.

DRAINAGE AREA (PLANIMETERED ON USGS QUAD SHEET): 0.37 mi^2

PMP CALCULATIONS (HMS REPORT 33)

AREA IS IN ZONE 1

24 HR., 200 SQ. MI. RAINFALL = 21"

HR.	%	RAINFALL	ΔRF
6	111	23.3"	23.3"
12	123	25.8"	2.5"
24	133	27.9"	2.1"
48	142	29.8"	1.9"

SNYDER COEFFICIENTS

FROM INFO. PROVIDED BY COE. (ZONE #1)

$$C_p = 0.45$$

and $C_t = 1.23$

$$t_p = C_t (L \cdot L_{ca})^{0.3}$$

$L = 1.2$ mi. $\quad L_{ca} = 0.5$ mi.

$$t_p = 1.23(1.2(0.5))^{0.3} = 1.06 \text{ HR}$$

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
ELM LAKE DAM	2	RRB	12/27/77	

DISCHARGE AT DAM SITE CALCULATIONS

SPILLWAY DISCHARGE W/ RESERVOIR SURFACE @ DESIGN TOP OF DAM:

$$Q = C L H^{3/2}$$

$C \cong 3.5$, $L = 16$ FT., $H = 5$ FT.

$$Q = 626 \text{ CFS}$$

MAX. KNOWN FLOOD (ESTIMATE)
1.5' ABOVE SPILLWAY CREST → $Q = (3.5)(16)(1.5)^{1.5} = 103$ CFS

OUTLET WORKS DISCHARGE CAPACITY:

$$H = \frac{V^2}{2g} + k_{ent.}\frac{V^2}{2g} + k_{BEND}\frac{V^2}{2g} + k_{ex.}\frac{V^2}{2g} + h_f$$

H = AVAILABLE HEAD
$k_{ent.}$ = ENTRANCE LOSS COEFFICIENT
k_{ex} = EXIT LOSS COEFFICIENT
k_{BEND} = BEND LOSS COEFFICIENT

$$h_f = \frac{29 n^2 L}{R_h^{1.33}}\left(\frac{V^2}{2g}\right)$$

$n = .015$
L = LENGTH OF PIPE = 130 FT.
R_h = HYDRAULIC RADIUS = $D/4$ = 0.5 FT

$$h_f = \frac{29(.015)^2(130)}{(0.5)^{1.33}}\left(\frac{V^2}{2g}\right) = 2.1\ V^2/2g$$

$k_{ent.} \cong 1.0$, $k_{ex.} \cong 0.5$, $k_{BEND} \cong 0.5$

$$H = 1 + 1 + .5 + .5 + 2.1 = 5.1\ V^2/2g$$

O'BRIEN & GERE ENGINEERS

SUBJECT	SHEET	BY	DATE	JOB NO
ELM LAKE DAM	3	RRG	12/27/78	

$$\frac{V^2}{2g} = \frac{Q^2}{2gA^2} \qquad (Q = VA)$$

$$H = 5.1 \frac{Q^2}{2gA^2} \qquad H = 5.1 \frac{Q^2}{2(32.2)[(\pi)(1)^2]^2}$$

$$H = .0080\ Q^2$$

AT NORMAL POOL, $H \cong 22$ FT.

AT MAXIMUM NON-OVERTOPPING POOL, $H = 27$ FT.

$H = 22$ FT, $Q = 52$ CFS

$H = 27$ FT, $Q = 58$ CFS

DISCHARGE CAPACITY OF OUTLET WORKS $\cong$ 55 CFS

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 SEP 78
**********
    1              A1                                NATIONAL DAM INSPECTION PROGRAM
    2              A2                                        ELM LAKE DAM
    3              A3                                     PMF HYDROGRAPH
    4              B     100       0      30       0       0       0       0       0      -4       0
    5              B1      5
    6              J       1       9       1
    7              J1     .2      .3      .4      .5      .6      .7      .8      .9     1.0
    8              K       0      A1                                       1
    9              K1                                RUNOFF TO ELM LAKE
   10              M       1       1    0.37                                                   1
   11              P       0      21     111     123     133
   12              T                                                       1.0    0.05
   13              W    1.06    0.45
   14              X    -1.5    -.05       2
   15              K       1      A2                                       1
   16              K1                             ROUTING THROUGH RESERVOIR
   17              Y                                       1       1
   18              Y1      1                                          -1410.1
   19              SA              27.8    38.6    56.7
   20              SE    1387    1410    1420    1440
   21              SS    1410      16     3.5     1.5
   22              SD    1415     3.1     1.5    1525
   23              K       99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	A1
ROUTE HYDROGRAPH TO	A2
END OF NETWORK	

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 SEP 78
**********

RUN  DATE= 03/14/79.
     TIME= 07.46.07.
```

NATIONAL DAM INSPECTION PROGRAM
ELM LAKE DAM
PMF HYDROGRAPH

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	30	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS=	.20	.30	.40	.50	.60	.70	.80	.90	1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

RUNOFF TO ELM LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.37	0.00	.37	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.00	111.00	123.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LRUPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.06 CP= .45 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 19 END-OF-PERIOD ORDINATES, LAG= 1.06 HOURS, CP= .45 VOL= 1.00

28.	81.	94.	71.	52.	39.	29.	21.	16.	12.
9.	6.	5.	4.	3.	2.	1.	1.	1.	

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP 0	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP 0
									SUM	22.34	20.49	1.85	10269.
										(568.)	(521.)	(47.)	(290.79)

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1410.	0

SURFACE AREA=	0.	28.	39.	57.
CAPACITY=	0.	213.	544.	1491.
ELEVATION=	1387.	1410.	1420.	1440.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1410.0	16.0	3.5	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1415.0	3.1	1.5	1525.

PEAK OUTFLOW IS 100. AT TIME 19.00 HOURS

PEAK OUTFLOW IS 162. AT TIME 19.00 HOURS

PEAK OUTFLOW IS 226. AT TIME 19.00 HOURS

PEAK OUTFLOW IS 293. AT TIME 19.00 HOURS

PEAK OUTFLOW IS 360. AT TIME 19.00 HOURS

PEAK OUTFLOW IS 428. AT TIME 18.50 HOURS

PEAK OUTFLOW IS 499. AT TIME 18.50 HOURS

PEAK OUTFLOW IS 570. AT TIME 18.50 HOURS

PEAK OUTFLOW IS 691. AT TIME 18.50 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1 .20	RATIO 2 .30	RATIO 3 .40	RATIO 4 .50	RATIO 5 .60	RATIO 6 .70	RATIO 7 .80	RATIO 8 .90	RATIO 9 1.00
HYDROGRAPH AT	A1	.37	1	194.	292.	389.	486.	583.	680.	778.	875.	972.
	(	.96)	(	5.50)(	8.26)(	11.01)(	13.76)(	16.51)(	19.27)(	22.02)(	24.77)(	27.52)
ROUTED TO	A2	.37	1	100.	162.	226.	293.	360.	428.	499.	570.	691.
	(	.96)	(	2.82)(	4.58)(	6.41)(	8.29)(	10.19)(	12.13)(	14.13)(	16.14)(	19.58)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

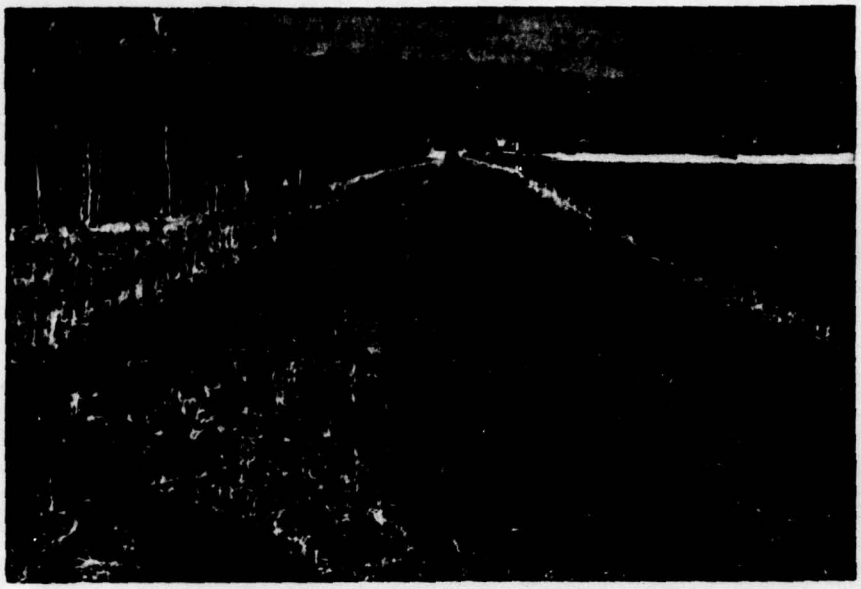
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1410.10	1410.00	1415.00
STORAGE	216.	213.	365.
OUTFLOW	2.	0.	626.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1411.47	0.00	255.	100.	0.00	19.00	0.00
.30	1412.03	0.00	272.	162.	0.00	19.00	0.00
.40	1412.54	0.00	287.	226.	0.00	19.00	0.00
.50	1413.01	0.00	301.	293.	0.00	19.00	0.00
.60	1413.46	0.00	315.	360.	0.00	19.00	0.00
.70	1413.88	0.00	329.	428.	0.00	18.50	0.00
.80	1414.30	0.00	342.	499.	0.00	18.50	0.00
.90	1414.70	0.00	355.	570.	0.00	18.50	0.00
1.00	1415.05	.05	367.	691.	.50	18.50	0.00

APPENDIX

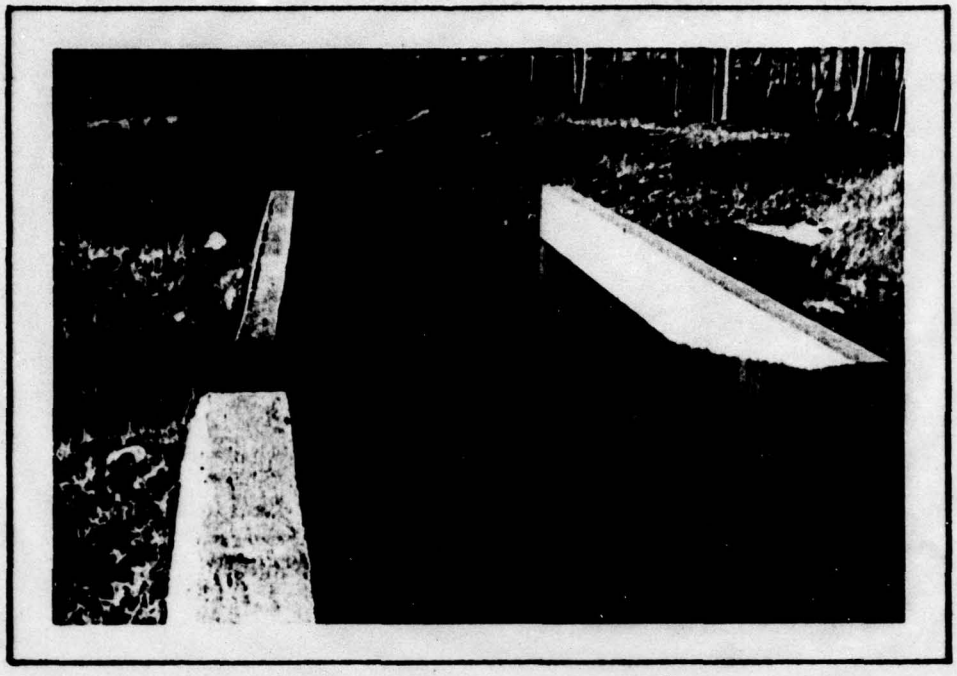
D

Photographs



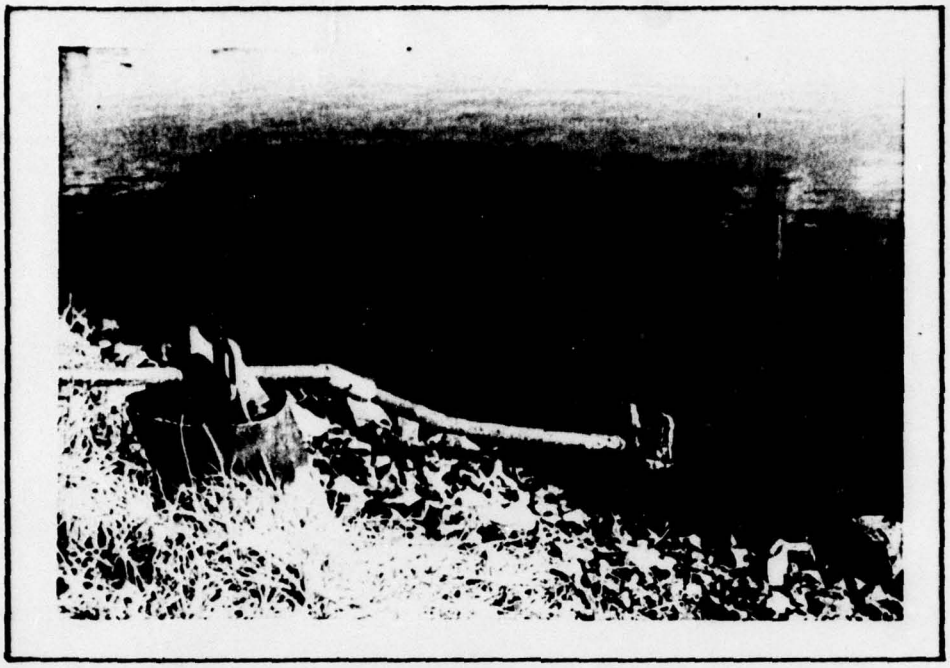
VIEW ALONG TOP OF DAM
LOOKING TOWARDS RIGHT ABUTMENT

UPSTREAM FACE OF DAM
LOOKING TOWARDS RIGHT ABUTMENT



SPILLWAY AND OUTLET CHANNEL
LOOKING FROM SPILLWAY CREST

MARSHY REGION WHICH STARTS
ABOUT 100 YARDS DOWNSTREAM OF THE DAM



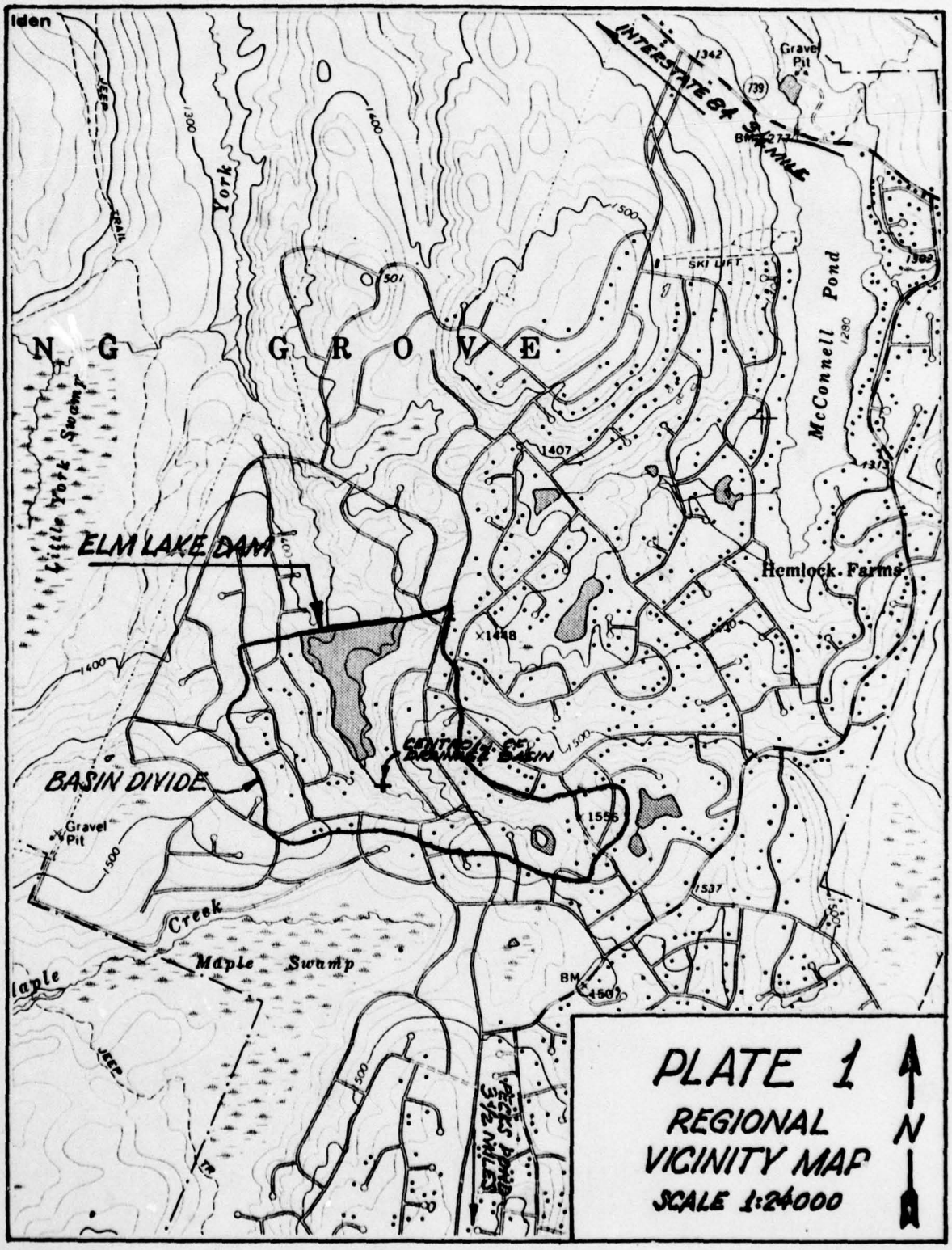
POORLY MAINTAINED HOIST STEM
OF THE RESERVOIR DRAIN SYSTEM

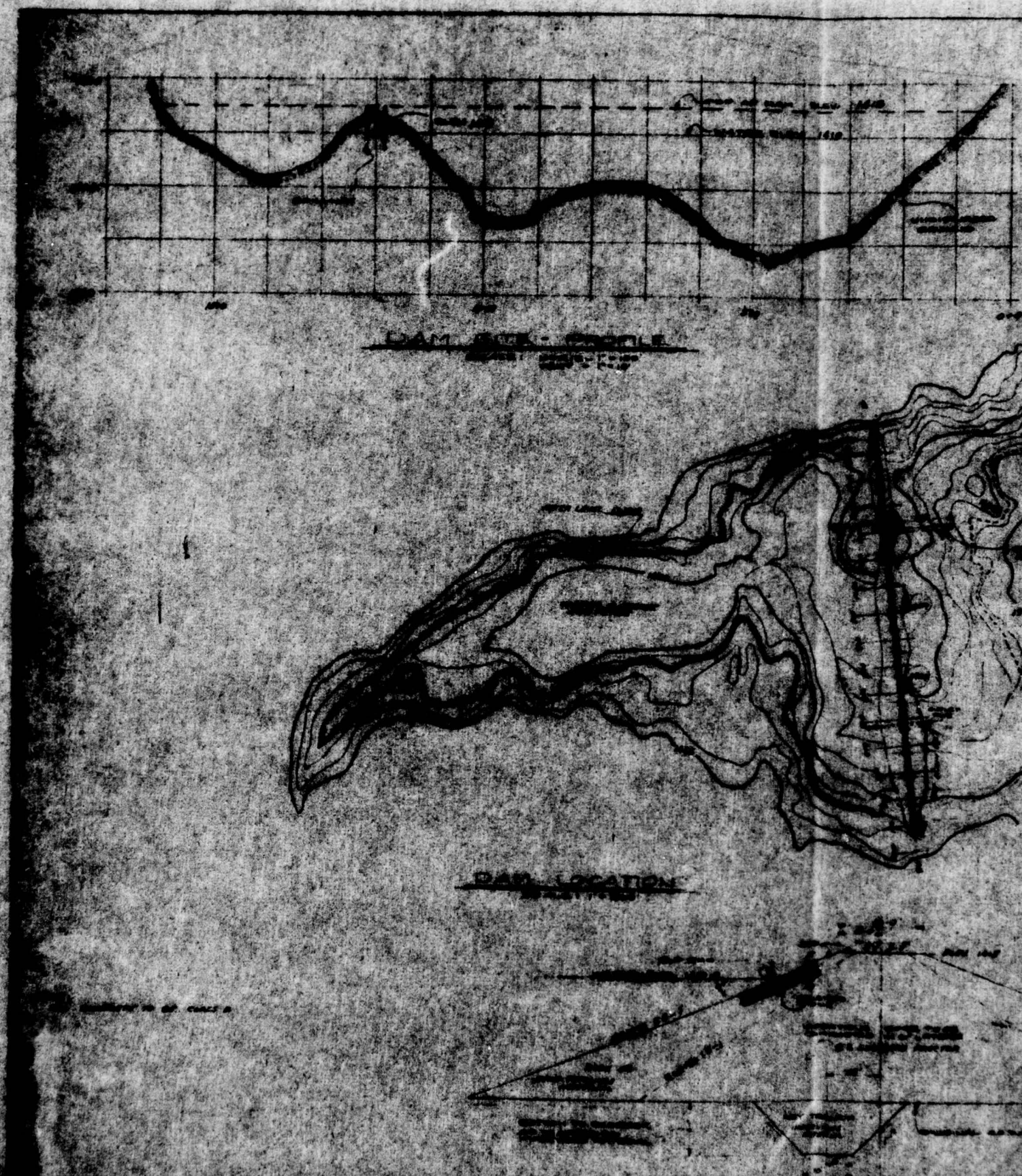
PARTIALLY BURIED RESERVOIR
DRAIN OUTLET STRUCTURE

APPENDIX

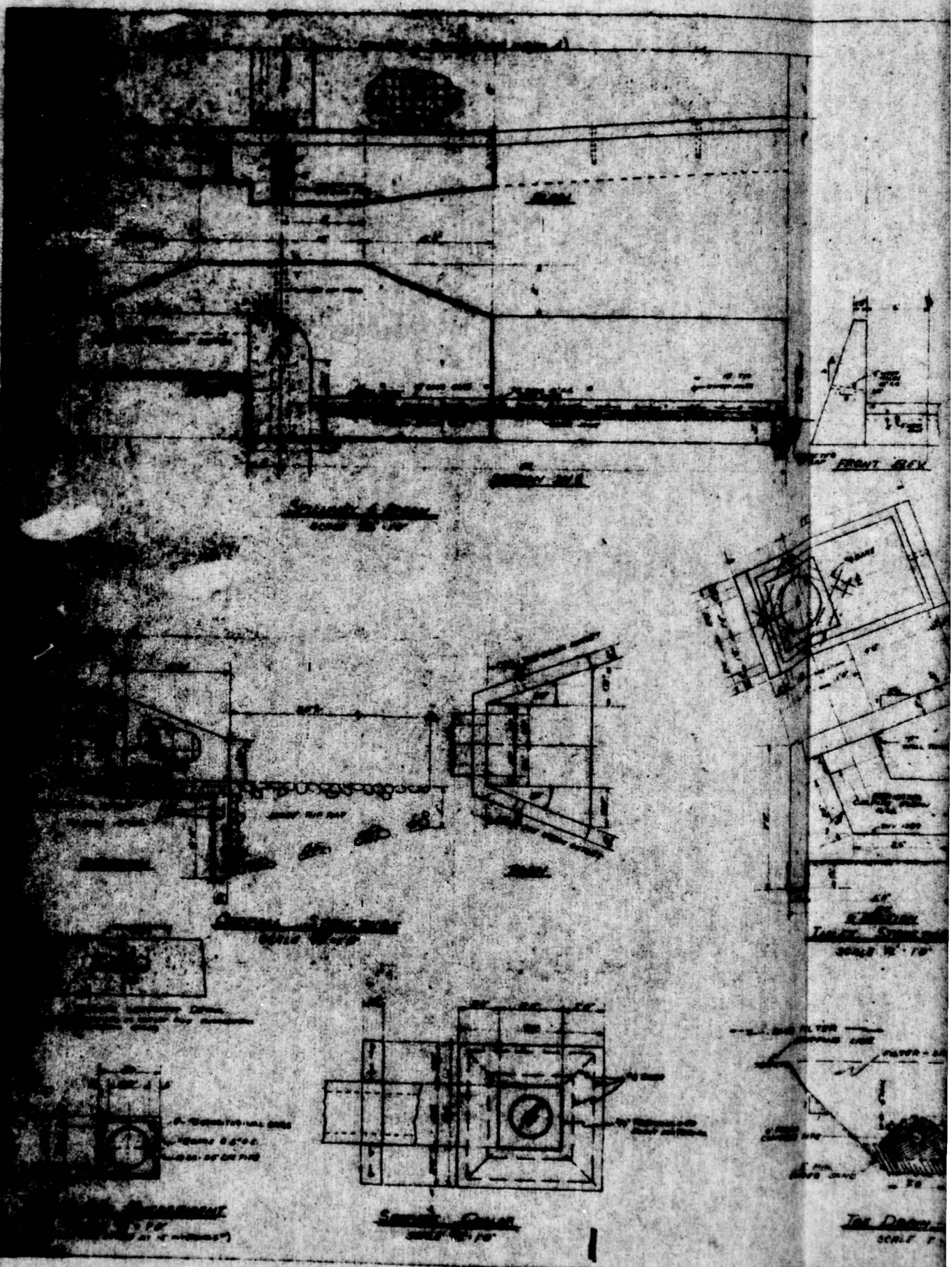
E

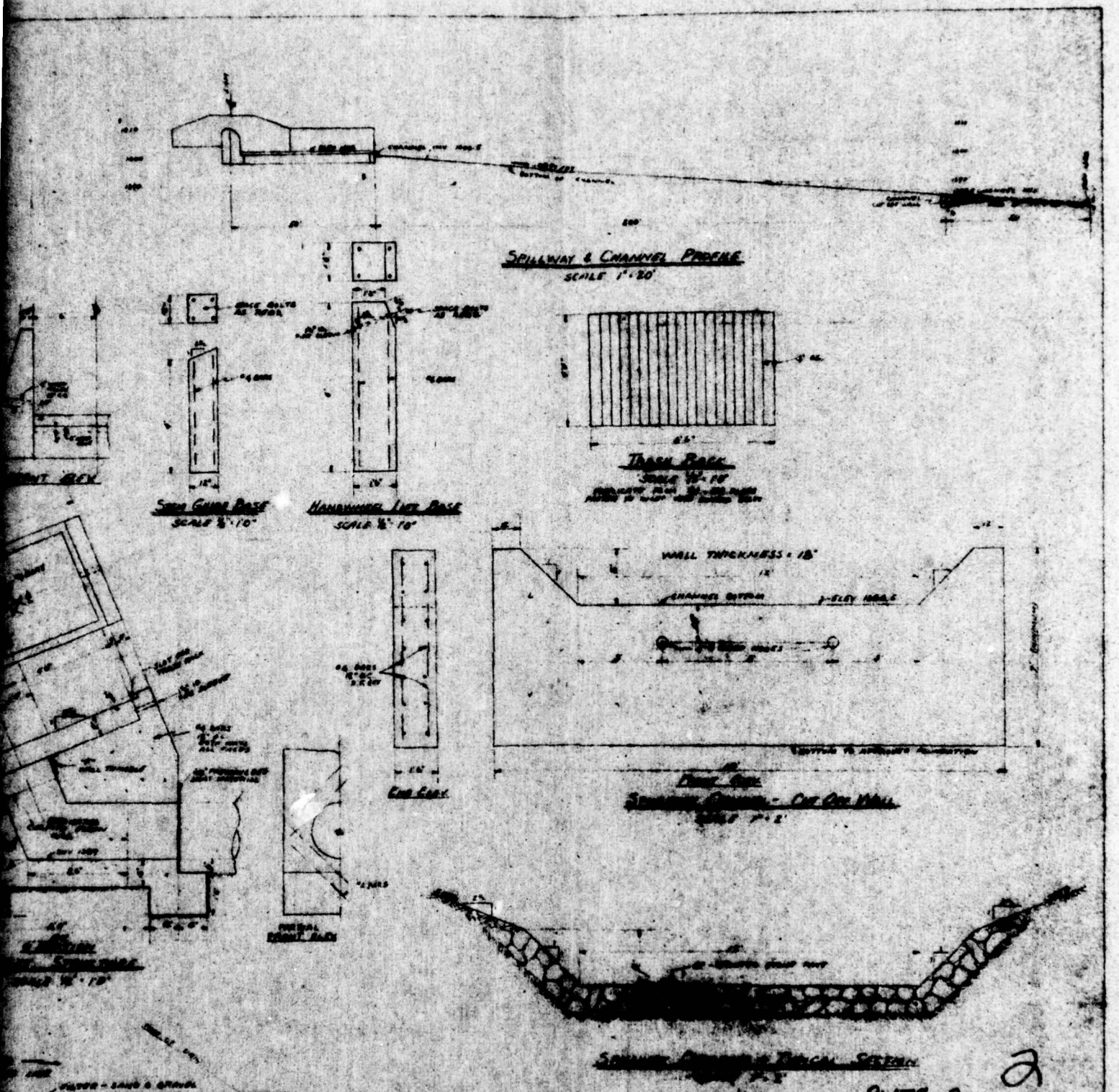
Drawings


Iden
INTERSTATE 84
Gravel Pit
SKI LIFT
York
Jeep Trail
N G G R O V E
McConnell Pond
Hemlock Farms
Little York Swamp
ELM LAKE DAM
BASIN DIVIDE
Gravel Pit
Creek
Maple Swamp
Maple
Jeep Trail
BM 1502
PLATE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N




LOCATION MAP
GATE 2


FRONT RACK


SPILLWAY & CHANNEL PROFILE
SCALE 1" = 20'
TRASH RACK
SCALE 1/2" = 1'0"
SERVICE GATE BASE
SCALE 1/2" = 1'0"
HANDWHEEL JACK BASE
SCALE 1/2" = 1'0"
WALL THICKNESS = 18"
CHANNEL SECTION
SERVICE GATE DATA:
PLATE 3
WESTERN HERITAGE PROPERTIES
HEMLOCK FARM COMMUNITY
BLOOMING GROVE TWP PIKE COUNTY, PA.
YORK LAKE # 1
DAM - DETAILS
SCALE: AS SHOWN
EDWARD C. HESS ASSOCIATES
STROUDSBURG, PA.

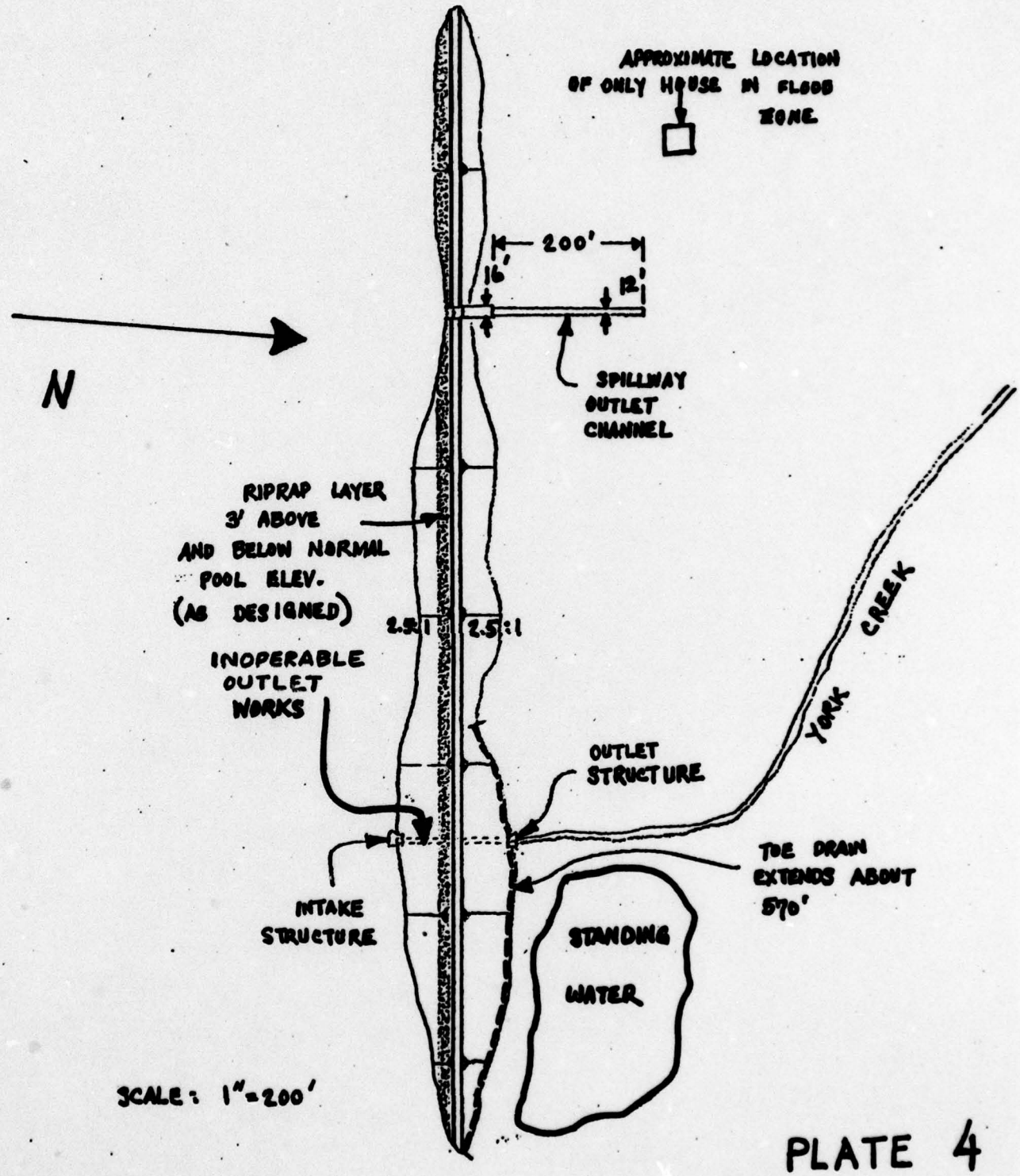


PLATE 4

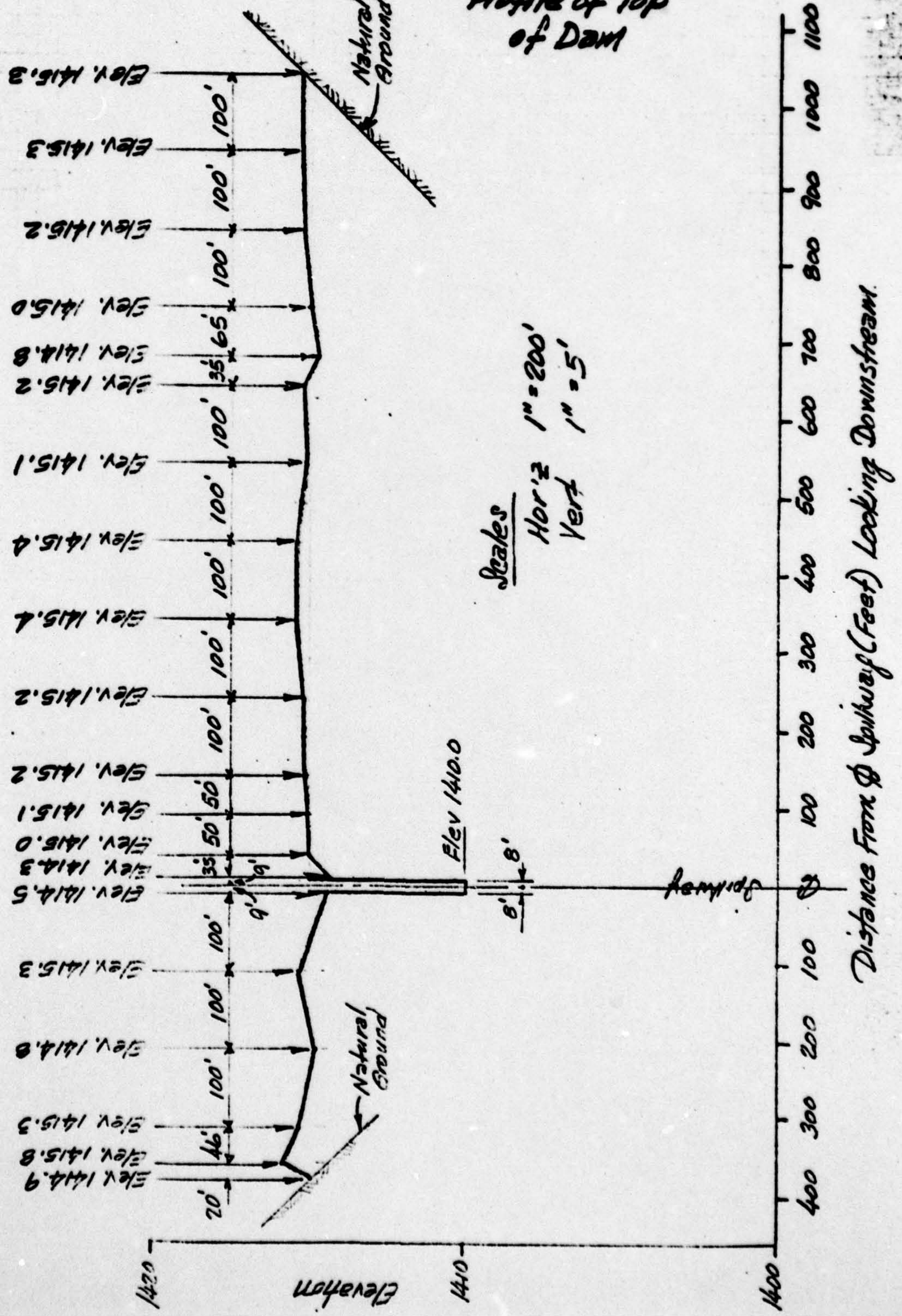
GENERAL PLAN DRAWING

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Elm Lake Dam		[illegible]	3/12/79	

PLATE 5

Profile of Top of Dam



APPENDIX

F

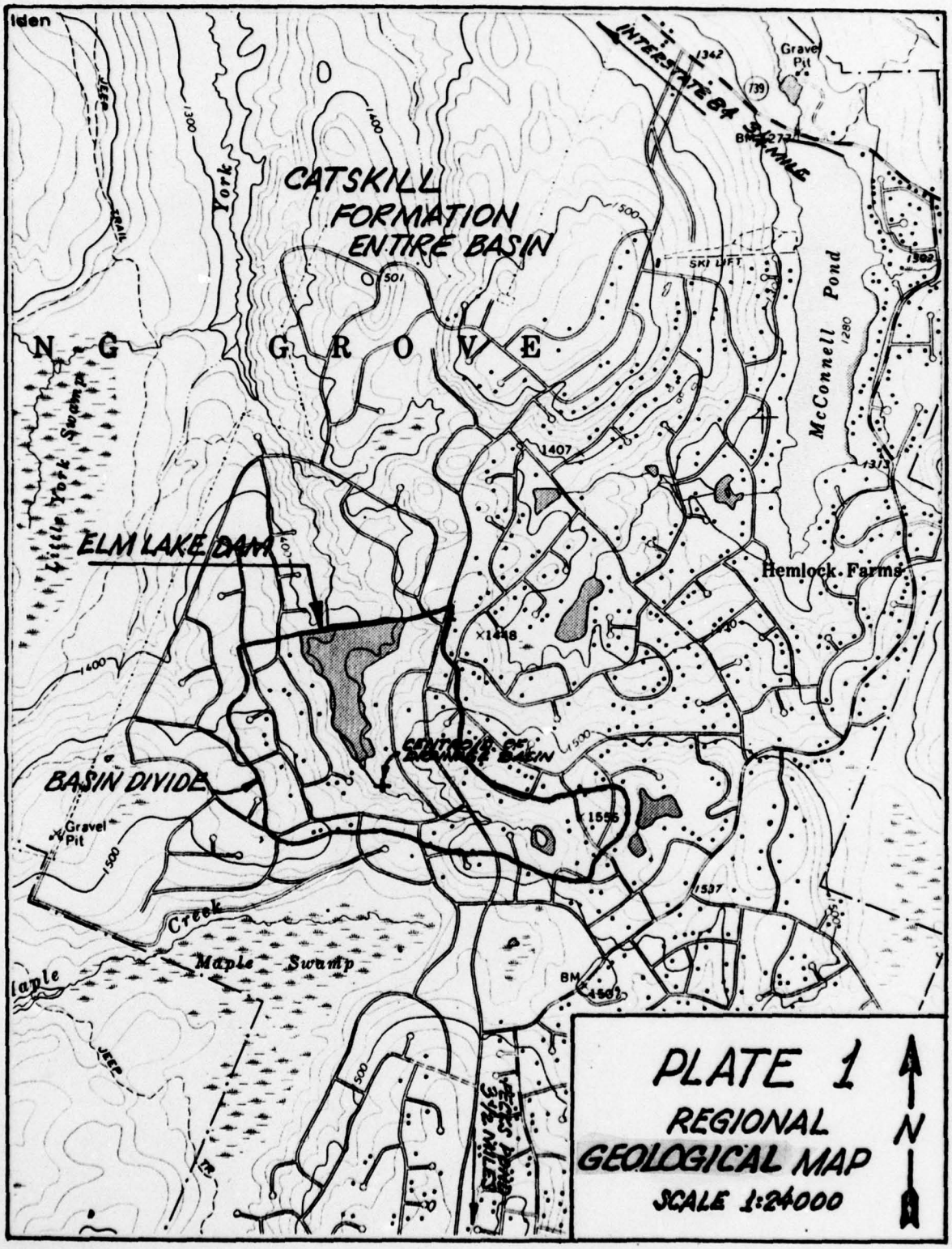
Site Geology

SITE GEOLOGY

ELM LAKE

Elm Lake is situated in Pike County and within the limits of the Eastern Glaciated section of the Appalachian Plateau physiographic province. Thick deposits of glacially derived debris and till cover the nearly horizontally bedded, red, gray and green shale and sandstone units of the Devonian Catskill group of continental sediments. The dam and lake both rest on glacial till and ground moraine deposits which are dense, compact and relatively impermeable. Prior to construction of the lake the area was covered with high valley swamps and bogs, attesting somewhat to the compactness and impervious nature of the dense, glacial till mantle.

No known faults or major structural defects occur in the bedrock in the vicinity of the dam and lake.


Iden
CATSKILL
FORMATION
ENTIRE BASIN
N G
G R O V E
ELM LAKE DAM
BASIN DIVIDE
Gravel Pit
Little York Swamp
York
Trail
INTERSTATE 84
Gravel Pit
McConnell Pond
Hemlock Farms
SKI LIFT
Maple Swamp
Creek
Jeep
BM
1407
1538
1537
1400
1500
1300
PLATE 1
REGIONAL
GEOLOGICAL MAP
SCALE 1:24000
N